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Importing, Exporting and Innovation in Developing Countries

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Abstract

Recent studies have shown that not only exporters but also importers perform better than firms that do not trade. Using a detailed firm level dataset from 43 developing countries, I show that there are persistent differences in evolution of firms when they are grouped according to their trade orientation as: two-way traders (both importing and exporting), only exporters, only importers, and non-traders. Extending the existing models of firm evolution in open economies by incorporating importing decision, I show that: i) globally engaged firms are larger, more productive, and grow faster than non-traders; ii) two-way traders are the fastest growing and most innovative group who are followed by only-exporters; iii) estimating export premium without controlling for import status is likely to overestimate the actual value by capturing the import premium; and iv) R&D investment contributes to growth of traders significantly more than to non-traders. Finally I show the robustness of the findings by providing evidence from the panel data constructed from the original dataset and controlling for variables that are likely to affect firm growth.

This paper—a product of the Enterprise Analysis Unit, Finance and Private Sector Development Department—is part of a larger effort in the department to explore the relation between international trade and growth. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at mseker@worldbank.org.

Importing, Exporting and Innovation in Developing Countries[¥]

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1 Introduction

The availability of detailed firm level datasets has led to the emergence of a new line of research that relates openness to trade with firm performance. Both theoretical and empirical findings, as reviewed in Bernard et al. (2007) and Lopez (2005), show that firms that are engaged in international trade are larger and more productive than the ones that serve only domestic markets. This study contributes to the existing literature in two ways. It shows that not only exporting but also importing intermediate goods is related to better firm performance in growth and in introducing technological innovations. The firms that are exposed to foreign markets by both importing and exporting are the best performers in the economy and they are usually followed by only exporters and by only importers in respective order.

In this study, using a detailed dataset from the manufacturing sectors of 43 developing countries, I provide evidence on the positive relation between foreign exposure of firms and their evolution. The analysis has two novel features. First, I provide a complete view of the trading activities of firms by grouping them according to their exposure to foreign markets. I distinguish firms that both import and export (two-way traders), that only export, and that only import. This allows me to compare firms' evolution with different levels of foreign exposure. Second, such detailed analysis is scarce for developing countries. As a result of globalization, firms in developing countries have been increasing their engagements with the rest of the world and determining how these engagements affect their evolution is important for identifying the right trade policies.

Recent models of trade and firm heterogeneity have mostly evolved around the exporting behavior of firms. Many studies since Bernard and Jensen (1995) have shown that exporters outperform non-exporters in many dimensions. Different explanations have been proposed for these persistent differences across firms among which the most acknowledged one is the self-selection of productive performers into foreign markets. Exporting requires extra sunk costs and only the most productive firms can compensate these costs. Clerides et al. (1998), Bernard and Jensen (1999), and Aw et al. (1998) provide empirical evidence for the self-selection hypothesis and theoretical models like Melitz (2003) and Bernard et al. (2003) build this stylized fact into general equilibrium trade models.

Another activity that is equally crucial as exporting for firms' better performance is importing. In his survey on technology diffusion, Keller (2004) summarizes theoretical and empirical literature on how imports provide knowledge and technology transfer in a macro perspective. In studies like Romer (1990), Grossman and Helpman (1991), Kortum (1997), and

Eaton and Kortum (1999, 2002), the use of imported intermediate goods implicitly involves the use of technology and knowledge embodied in them. However these studies analyze the gains from importing in an aggregate setting rather than the effects of importing on firm performance.

Recently, using micro level data from developed countries, some empirical studies have shown that importers show similar characteristics as exporters. In their review of firms in international trade, Bernard et al. (2007) compare the characteristics of exporting and importing firms in the US manufacturing census. They show that both types of firms show many similarities in their performance measures. Both exporters and importers are more productive, larger, capital and skill intensive than firms that do not have any trading relations with the rest of the world. Another study that shows a positive relationship between importing intermediate goods and productivity for Belgian firms is Muuls and Pisu (2007). However neither study discusses the relation between firms' trade orientation and technological innovation.

In analyzing how firm evolution is related to foreign exposure, I introduce a simple theoretical model. Since the seminal works of Grossman and Helpman (1991), Aghion and Howitt (1992), and Romer (1990), many studies in the endogenous growth literature have found technological innovation to be the main determinant of growth. Following these studies, Klette and Kortum (2004) present a highly stylized model of firm and industry evolution. To their framework, I introduce exporting and importing decisions in a similar fashion to Melitz (2003)[1] and show how firms with different levels of global engagements differ in their evolution.

In determining how firms evolve, I look at growth rates of size measured as sales and employment and growth rate of labor productivity measured as sales per worker. In addition to these measures of growth, I analyze whether firms implement technological innovations. Enterprise Surveys collect information on several variables to measure innovation[2]. I look at the probabilities of introducing new products, improving any existing process, having any internationally recognized quality certificate, and using foreign-licensed technologies. The use of various measures of firm evolution provides robustness to the inferences derived on the relation between firm evolution and trade.

Only a few studies that use micro level data explore the links between technological innovation and trade in developing countries. This is a crucial question because the most significant source of technological progress in developing countries is related to their ability to absorb the technology created in developed countries. Almeida and Fernandes (2008) and Alvarez and Robertson (2004) provide two studies that analyze innovation in developing countries and only the

[1] Melitz (2003) only considers exporting choice of firm.
[2] See www.enterprisesurveys.org for the detailed description of the data and methodology.

former one controls for the import status of firms. Yet, neither study divides firms into four groups according to their trade orientation and hence cannot show the complementary relation between importing and exporting activities as clearly as presented here.

This study derives four important results on the relation between firms' global engagement level and their performance: i) globally engaged firms are larger, more productive, more capital intensive, and pay higher wages than purely domestic firms; ii) among exporters, firms that import intermediate products are more productive and grow faster; iii) firms that only import intermediate products are more productive and grow faster than non-traders, however the distinction between exporters and non-traders is more significant; and iv) firms with foreign ownership grow faster but they are less innovative than domestically owned firms.

Importing and exporting can lead to better firm performance in different ways. Higher use of foreign inputs can increase firm productivity due to access to more variety of inputs or directly due to the higher quality of these products. On the other hand, exporting increases the market size of the firm which increases the future return of R&D investments. Eventually both activities decrease the cost of implementing technological innovations and spur growth.

There have been recent studies that incorporate R&D decisions in a framework that relates firm evolution and foreign exposure. Using data from Taiwanese manufacturers, Aw, Roberts, and Winston (2007) find a significant role of R&D investments in explaining firms' export patterns. They also analyze the effects of interaction between R&D investments and exporting on productivity growth. In this study, I explore whether investments in R&D affect evolution differently for firms with varying levels of global engagement. Introducing interaction terms of R&D with two-way traders, only importers, and only exporters, I show that investment in R&D significantly increases the growth rate of two-way traders and only importers. It also increases the innovation of two-way traders.

The rest of the paper is organized as follows. In section 2, I explain the analytical framework of the model. Following that I introduce the dataset and variables of interest. Then in section 4, I perform a descriptive analysis that relates firm performance with its trade orientation. In section 5, I elaborate on the relation between evolution of firm and its trade orientation controlling for factors that can potentially affect firm evolution. In section 6, I provide sensitivity analysis to check the robustness of the findings. Finally, I analyze the interaction between a firm's trade orientation with its R&D investment and finish with some concluding remarks.

2 Theoretical Model

A crucial contribution of this study is incorporating the importing decision to a firm's maximization problem. In a recent study, Halpern et al. (2005) analyze two channels by which imported products lead to productivity improvements in Hungary: their higher quality and imperfect substitution of foreign and domestic inputs. They show that two third of productivity increase caused by importing is attributable to an increase in the variety of intermediates used and the rest is due to an increase in quality. In another study, Amiti and Konings (2007), using data from Indonesia show that reducing input tariffs increase productivity three times more than a reduction in output tariffs. Both studies motivate for investigation of how importing relates to innovation and growth.

In the model, firms choose whether to import intermediate products and export any of their output facing fixed sunk costs for both markets. The sole factor determining firms' participation in international markets is their efficiency levels which is exogenously assigned to them. Then I incorporate these static trading decisions with a dynamic framework of firm evolution. The dynamic model of evolution follows from Klette and Kortum (2004). Firms invest in R&D and these investments result in innovation of new products in a stochastic fashion.

I assume that there are $N+1$ identical countries and in each country there are two sectors formed of final good producers and intermediate goods producers. In each country, a composite good Y is produced by a large group of monopolistically competitive final goods producers. Each firm produces multiple products (each of which is a different variety). Consumption of the composite good Y is determined by a CES production function given in equation 1 as

$$Y = \left(\int_{j \in J} y(j)^{\frac{\sigma-1}{\sigma}} dj \right)^{\frac{\sigma}{\sigma-1}}, \tag{1}$$

where j is an index over varieties chosen from a set J and $\sigma > 1$ is the elasticity of substitution between different varieties. Producers are distinguished only by their efficiency levels, indexed by $\varphi > 0$. The solution of this model follows from Melitz (2003). Under monopolistic competition, producers with same efficiency levels charge the same price and make the same profit for each product they produce. The static profit maximization problem for production of any product, for given wage rate w, yields revenue and profit given as

$$r(\varphi) = \left(\frac{p(\varphi)}{P} \right)^{1-\sigma} E \text{ and } \pi(\varphi) = \frac{r(\varphi)}{\sigma} \tag{2}$$

where $p(\varphi)$ is the price charged by the firm, P is aggregate price index and E is aggregate expenditure of the composite good (E=PY).

In production of the final goods, firms employ labor, domestically produced intermediate goods and choose whether or not to use imported intermediate goods. To be able to import the intermediate goods, firms incur sunk cost f_i . This sunk cost determines a threshold value for efficiency level $\overline{\varphi}$ such that firms with efficiency levels below $\overline{\varphi}$ can only use domestic intermediate goods in production. Their production function labeled as y^d which is given in equation 3

$$y^d(\varphi) = \varphi l^{\alpha}\left[\int_0^1 x_d(k)^{\frac{\gamma-1}{\gamma}} dk\right]^{\frac{(1-\alpha)\gamma}{\gamma-1}} . \tag{3}$$

Here, l measures amount of labor, x_d measures amount of domestic intermediate good k used in production, α is the measure of labor share ($0 < \alpha < 1$) in production and $\gamma > 1$ is the elasticity of substitution between any two intermediate inputs. In the intermediate goods sector, there is a continuum of firms producing differentiated goods and they have access to the same linear production technology with $x_d = l$.

Solving the profit maximization problem of the final goods producer in a symmetric equilibrium, we get $x_d(k) = x_d$ for all k. Total revenue for each product of a φ-type producer participating in only domestic market is

$$r^d(\varphi) = \left(\frac{w}{\alpha^{\alpha}(1-\alpha)^{1-\alpha} P\varphi}\frac{\sigma}{\sigma-1}\right)^{(1-\sigma)} E . \tag{4}$$

On the other hand, firms with efficiency levels higher than $\overline{\varphi}$ will be able to import intermediate products using the production function given in equation 5

$$y^{imp}(\varphi) = \varphi l^{\alpha}\left[\int_0^1 x_d(k)^{\frac{\gamma-1}{\gamma}} dk + \int_0^N x_i(k)^{\frac{\gamma-1}{\gamma}} dk\right]^{\frac{(1-\alpha)\gamma}{\gamma-1}} , \tag{5}$$

where x_i measures imported intermediates used in production[3]. In this specification of the production function, firms that import intermediate goods gain access to a wider range of intermediates than firms using only domestic intermediates. An alternative approach for modeling the production function in equation 5 can be allowing imported intermediates to embody higher quality levels than the domestic intermediates. Instead of benefiting from accessing to more variety of inputs, importers will benefit from using higher quality inputs which will allow them to generate more output[4]. Since either interpretation would lead to a similar analytical framework, I will use

[3] Kasahara and Lapham (2007) use the same production function in their analysis of trade and firm performance. However their model is solved in a static setup.
[4] This interpretation for imported intermediates is used in Halpern, Koren, and Szeidl (2006).

the first interpretation. Solution to the profit maximization problem of an importing firm gives $x_i(k) = x_i$ for all k and $x_i = x_d$ [5]. This solution leads to a production function

$$y^{imp}(\varphi) = \varphi(1+N)^{\frac{(1-\alpha)}{\gamma-1}} l^{\alpha}(x_d + Nx_i)^{1-\alpha\frac{(1-\alpha)\gamma}{\gamma-1}} .$$

Here $\varphi(1+N)^{\frac{(1-\alpha)}{\gamma-1}} > 1$ is the residual from output once labor and total use of intermediate goods is excluded. This residual can be interpreted as a productivity term. Hence the use of imported intermediate goods leads to higher productivity[6]. Next, total revenue from each product for a φ-type producer who only imports can be written as

$$r^{impO}(\varphi) = (1+N)^{\frac{(1-\alpha)(\sigma-1)}{\gamma-1}} r^d(\varphi) \text{ with } (1+N)^{\frac{(1-\alpha)(\sigma-1)}{\gamma-1}} > 1 . \qquad (6)$$

In order to export, firms have to incur an additional sunk cost f_x. Similar to the choice of importing only firms with efficiency levels above a threshold level $\overline{\overline{\varphi}}$ will be able to export. In a symmetric equilibrium, total revenue gained by a firm who exports to N countries but does not import will be $r^{\exp O}(\varphi) = \left((1+N)r^d(\varphi)\right)$ and the revenue gained by a firm who both imports and exports will be $r^{\exp/imp}(\varphi) = \left((1+N)r^{impO}(\varphi)\right)$.

The profit levels that would be gained from different levels of trade engagement can be easily compared. After adjusting the optimal profit level from equation 2 with the relevant fixed cost of trading, we get $\pi^{\exp/imp} > \left\{\pi^{\exp O}, \pi^{impO}\right\} > \pi^d$. The comparison shows that two-way traders generate the highest profits, which are followed by firms that either export or import. Non-trading firms generate the lowest amount of profit.

Having solved the static trading problem of a firm, next I present the dynamic framework that allows firm to grow through introducing new products to the economy. Firms innovate new products at rate I which depends on both their R&D investment R and the existing stock of knowledge capital. The knowledge capital stands for all skills, techniques, and know-how that firms use in their attempts to innovate. Knowledge capital of a firm can be proxied by the number of products that it currently produces n[7]. Then innovation function can be written as

$$\mathrm{I} = \mathrm{F}(\mathrm{R}, \mathrm{n}) .$$

This function is strictly increasing and homogeneous of degree one in both R and n. Under these assumptions, R&D cost can be written as a function of I and n as R=c(I/n)n. Here I/n determines innovation intensity of firm which I denote as λ.

[5] For simplicity I didn't include any iceberg transportation cost in the mode.
[6] This result is derived in Kasahara and Lapham (2007).
[7] See Klette and Kortum (2004) for a detailed discussion of the innovation function introduced here.

Firms face an exogenously fixed probability μ of losing their products. Based on this setup, dynamics of firm evolution is modeled as follows. A firm of efficiency type φ, with a current flow of profits $\pi(\varphi)$n , faces a Poisson hazard μn of losing a product. By spending in R&D it influences the Poisson hazard *I* of becoming a firm with n+1 products. The firm chooses optimal amount of R&D to maximize its expected present value $V_\varphi(n)$. Bellman equation for firm's problem is

$$rV_\varphi(n) = \max_{\lambda > 0} \left(\pi(\varphi)n - wc(\lambda)n + \lambda n \left[V_\varphi(n+1) - V_\varphi(n) \right] - \mu n \left[V_\varphi(n) - V_\varphi(n-1) \right] \right)$$

where *r* is the interest rate and *w* is the wage rate. The value function is linear in n which allows us to get a simple solution to the problem which is given in equation 7. It shows that optimal amount of innovation intensity λ is determined by setting marginal cost of innovation equal to marginal benefit[8]

$$c'(\lambda) = \frac{\pi(\varphi) - wc(\lambda)}{r + \mu - \lambda}. \tag{7}$$

Firms with higher values of λ introduce new products at a faster speed and grow faster. Equation 7 shows that higher profit level shifts up marginal benefit of innovation and leads to higher innovation (by increasing λ)[9].

2.1 Discussion of the Model

Based on the analytical framework presented above, it is easy to see how engagement in global markets spurs growth. As was shown before $\pi^{\exp/imp} > \left\{ \pi^{\exp O}, \pi^{impO} \right\} > \pi^d$ and higher profit leads to faster growth. Exports contribute to technological innovation through increasing firm market size and profits which in return increases potential gains of a successful innovation. This idea is also used in the theoretical models of Constantini and Melitz (2007) and Lileeva and Trefler (2007).

There has been studies that provide empirical evidence on the correlation between exporting and technology adoption or R&D investment such as Aw, Roberts, and Xu (2008), Aw, Roberts, and Winston (2007), and Bernard and Jensen (1997). In my model, more efficient firms self-select themselves into export market and make higher profits than domestic firms. More efficient firms also invest more in R&D. This explains the positive correlation between exporting and R&D.

[8] Details of solution of the Bellman equation under heterogeneous firm types are given in Lentz and Mortensen (2008) who introduce heterogeneity in profit levels to the setup of Klette and Kortum (2003).
[9] A formal proof of this relation is given in Klette and Kortum (2003).

Imports contribute to innovation through access to more varieties to produce output. This increases their productivity and results in higher profit. Using data from Indian firms, Goldberg et al. (2008) provide empirical evidence on how imported intermediate goods increase new product innovation in the economy.

Since both exports and imports are likely to lead to more innovation and growth, firms that perform both activities should be more likely to perform better than the ones who perform only one of the activities. In the reduced form model introduced in the empirical section, I test these relations. More specifically, I test the hypothesis whether firms that are engaged in global markets either through importing or exporting grow faster and innovate more than the firms who participate only in the domestic markets.

3 Data

For the analysis, I use plant[10] level data collected through the World Bank's Enterprise Surveys. The surveys cover a rich set of developing countries from different regions of the world. In the survey of each country, a random sample of firms is selected that is representative of the manufacturing industry. The sample of firms is stratified by size, and location. A total of 27,754 firms from the manufacturing industries of 43 developing countries are used in the analysis. The surveys conducted in 2002, 2005, and 2008 cover Eastern European and Central Asian countries (ECA surveys). The 2006 survey covers the Latin American and Caribbean countries (LAC survey)[11]. Table 1 shows the number of firms included in each survey. Details of the observations from countries are given in Table 16 in the Appendix. In addition to the cross-sectional data, there are 2,911 firms from 31 countries that were surveyed twice in three years. The number of firms included in this panel is given in Table 2.

Table 1 Survey Summary

	Percent
ECA 2002	23
ECA 2005	34
ECA 2008	18
LAC 2006	25
Total	27,754

[10] Although, in the surveys unit of observation is plant, I use firm in the rest of the paper. In the LAC 2006 and ECA 2008 surveys, firms were asked whether they are a part of a larger firm. 89% of 6919 firms in LAC survey and 90% of 5063 firms in ECA 2008 survey who answered to this question own a single plant. The multi-plant firms make 34% of total employment in LAC region in 2006 and 20% of total employment in ECA region in 2008.

[11] Data in the surveys refers to the last fiscal year when the survey was conducted (i.e. data in 2008 survey is from fiscal year 2007).

Table 2 Survey Summary- Panel Firms

Panel Years	Percent
ECA 2002-2005	36
ECA 2005-2008	24
LAC 2003-2006	40
Total	2,911

3.1 Industry Summaries

The manufacturing industries that are included in the analysis are listed in Table 3. The classification of the industries is made according to ISIC revision 3.1. Firms are divided into four groups according to their trade orientation: two-way traders, only importers, only exporters and non-traders. Table 3 shows the fraction of firms in each trade group. In almost all industries, non-traders make the largest group. Among the firms that trade, only importers have the largest share except textile industry. The high ratio of importers can be due to the imperfect substitutability between foreign and domestic inputs. It might also show that sunk cost of importing is less constraining than the sunk cost of exporting.

To see how engaged firms are with foreign markets, in Table 4, I show the percentage of imported intermediate goods by importing firms and percentage of output that is exported by exporting firms[12]. The table shows that the trading firms in the sample trade quite intensively. Amount of imported intermediate goods make 54% of total intermediate goods used for production and amount of exported goods make 41% of total revenues for two-way traders. The median values are close to the mean values especially for import intensity which supports the significance of participation in foreign markets of the firms.

Table 3 Manufacturing Industries – Trade Orientation of Firms

		Trade Shares in Industries (in %)				Totals
ISIC	Industry	Export/ Import	Import Only	Export Only	None	(%)
15	Food	21.0	34.7	7.3	36.9	10.54
18	Garments	17.6	38.0	4.9	39.5	10.18
17	Textiles	34.2	25.1	9.7	31.0	22.84
29	Machinery & Equipment	28.5	23.9	13.4	34.1	7.24
24	Chemicals	18.9	42.7	3.9	34.5	20.23
31	Electronics	14.0	18.4	9.3	58.3	5.96
26	Non-metallic Minerals	10.8	21.5	8.6	59.1	5.83
	Other Manufacturing	22.3	33.0	11.4	33.4	17.18
	Total	4947	6829	1768	7963	27,754

[12] I have done this table separately for each survey year and the percentages do not change much across regions or over time.

Table 4 Percentage of Goods Traded

	% Imported		% Exported	
	Mean	Median	Mean	Median
Export/Import	54	50	41	30
Export Only	-	-	41	30
Import Only	56	50	-	-

3.2 Variables of Interest

The broad scope of the survey allows me to observe a rich set of variables to analyze the underlying factors of firm evolution. The main focus of this study is to analyze the relation between firm evolution and its trade orientation. I use several variables to measure firm evolution. As direct measures of growth, I look at evolution of size measured as employment and sales and evolution of labor productivity. I also analyze different proxies for technological innovation. These measures are product and process innovation, use of quality certificates and foreign licenses. In examining the relation between firm evolution and trade, I control for a rich set of firm characteristics. A complete list of variables used in the analysis is given in Table 5. These variables are likely to affect firm evolution and without controlling for them, it is difficult to identify the exact relation between trade and growth. All data is provided from Enterprise Surveys database.

Data for ECA 2002 and 2005 are given in US dollars but 2006 LAC and 2008 ECA data were in local currencies. Nominal values are deflated using the GDP deflator from the World Bank Development Indicators database. All values are presented in 2000 constant US dollars and the exchange rate is taken from the International Financial Statistics database.

Table 5 Variable Descriptions

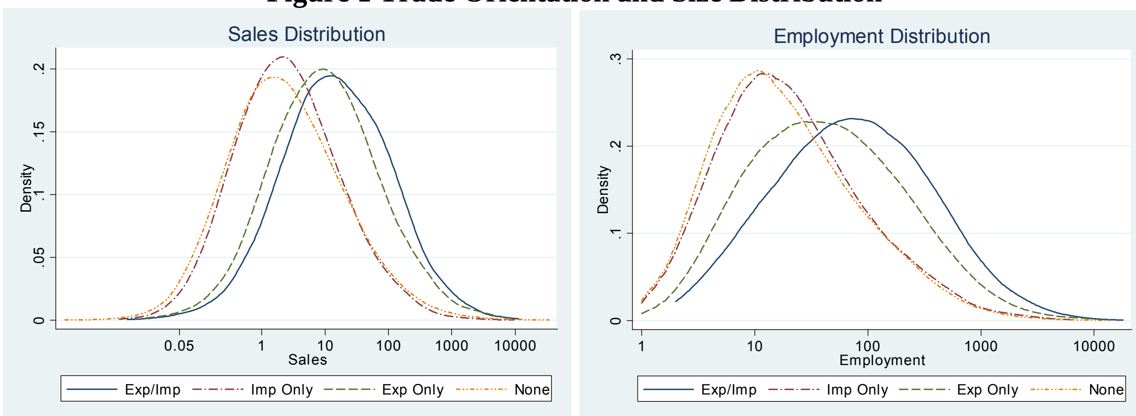
Variable	Definition
Export/Import	Dummy variable equal to one if the firm exported any output and imported any intermediate good.
Import Only	Dummy variable equal to one if the firm only imported any intermediate good.
Export Only	Dummy variable equal to one if the firm only exported any output.
None	Dummy variable equal to one if the firm neither imported nor exported any good.
Foreign (≥ %10)	Dummy variable equal to one if more than 10% of the firm is owned by private foreign individuals, companies or organizations.
Foreign (≥ %50)	Dummy variable equal to one if more than 50% of the firm is owned by private foreign individuals, companies or organizations.
Foreign (≤ %50)	Dummy variable equal to one if less than 50% of the firm is owned by private foreign individuals, companies or organizations.
Sales	Total annual sales.
Sales $_{t-3}$	Total annual sales three years ago.
Employment	Number of full time workers.
Employment $_{t-3}$	Number of full time workers three years ago.
Product Innovation	Dummy variable equal to one if the firm introduced onto the market any new or significantly improved products.
Process Innovation*	Dummy variable equal to one if the firm introduced any new or significantly improved production processes including methods of supplying services and ways of delivering products.
Foreign License*	Dummy variable equal to one if the firm uses technology licensed from a foreign-owned company.
Quality Certificate	Dummy variable equal to one if the firm has an internationally-recognized quality certification.
R&D Ind	Dummy variable equal to one if the firm spent on research and development activities, within the establishment or other companies contracted.
Wage	Total annual cost of labor (including wages, salaries, bonuses, social payments).
Investment	Total annual expenditure for purchases of machine, equipment, and building.
NonProd Worker Share	The share of non-production workers (e.g., managers, administration, sales) in all workers.
Training	Dummy variable equal to one if the firm runs formal training programs for its employees.
Age	Survey year minus year the firm started operation
Total Hrs/Week	Total number of hours per week that the establishment normally operates
Access to Finance	Dummy variable equal to one if the firm uses banks or other financial institutions to finance its investments.
Capacity Utilization	Firm’s current output in comparison with the maximum output possible using its facilities at the time.
Multi-plant Firm*	Dummy variable equal to one if the firm is part of a larger firm.
Log(Markup)†	Amount the sales price exceeds operating costs (i.e. the cost material inputs plus wage costs but not overheads and depreciation).

* These variables are only available for 2006 and 2008 surveys. † Markup information is only available for 2002 and 2005 surveys.

4 Descriptive Analysis of Trade Orientation and Firm Characteristics

Before introducing the reduced form model, I provide a descriptive analysis of the relation between foreign exposure and certain measures of firm performance. First, I look at size distribution. Dividing firms into four groups according to their trade orientation, in Figure 1, I show the distribution of sales and employment. Two-way traders (Exp/Imp) outperform other groups in both measures. They are followed by only exporters (ExpOnly) who are followed by only importers (ImpOly).

Figure 1 Trade Orientation and Size Distribution



Next, I look at the summary statistics for technological innovation according firms' trade orientations. Table 6 shows that firms with some foreign exposure are more innovative than non-traders. Traders are also more likely to own quality certificates and perform R&D. Among traders two-way traders are the most innovative group in all five measures.

Table 6 Fraction of Firms with Technological Innovation

	New Product	Process Improve	Foreign License	Quality Certificate	R&D Indicator
Export/Import	0.62	0.78	0.28	0.55	0.64
Import Only	0.49	0.67	0.15	0.33	0.53
Export Only	0.47	0.70	0.19	0.55	0.58
None	0.29	0.51	0.07	0.34	0.49

To investigate the differences among firms further, I estimate the premium in several performance measures according to firms' trade orientation. I run the descriptive regression given in equation 8

$$y_{ijc} = \beta_0 + \beta_1 d^{xm}{}_{ijc} + \beta_2 d^{x}{}_{ijc} + \beta_3 d^{m}{}_{ijc} + \gamma X_{ijc} + \delta I_j + \lambda I_c + \mu I_t + \varepsilon_{ijc}\,. \qquad (8)$$

Here y_{ijc} refers to a vector of attributes of firm *i* in industry *j* in country *c* such as sales, employment, labor productivity (measured as real sales per worker), wage, investment per worker, ratio of non-production workers to all workers, and growth rates[13]. The survey includes information about firms' employments and revenues in both last fiscal year and three years before that. Using

[13] In the surveys, there's no information about the exiting firms. Hence the growth rates are all measured as conditional on the survival.

this information, annualized growth rates are calculated. On the right hand side of the equation three dummy variables d^{xm}_{ijc}, d^{x}_{ijc}, and d^{m}_{ijc} represent two-way traders, only exporters, and only importers in respective order. X_{ijc} represents total employment to control for current size. For the growth rate regressions, instead of current size, I use past values of employment, sales, and productivity as controls. In addition, there is a vector of variables to control for 2-digit industry, country, and survey year effects listed in respective order I_j, I_c , and I_t. Controlling for country fixed effects allows me to isolate the potential differences in macro policies that may affect the evolution of firms. Similarly industry fixed effects account for differences in the level of competition, technology use and other factors that can create heterogeneity across industries. Since most of the performance measures are in log scale, coefficients measure the percentage differences between traders and non-traders. All standard errors are clustered to allow for possible correlations in performance measures across firms within the same country, industry, and year. In the regressions for growth rates of employment, sales, and productivity, I control for outliers by excluding firms with growth rates that are more than four standard deviations away from the average value in each country.

Table 7 Descriptive Regression (Pooled Cross-sectional Ordinary Least Squares)

Dependent Variable	Log (Sales)	Log (Employment)	Log (Productivity)	Sales Growth	Prod Growth	Employ Growth	Log (Wage)	Log(Invest /Worker)	NonProd /Prod
Export/Import	2.012	1.532	0.422	0.062	0.042	0.038	0.272	0.359	0.318
	(0.055)***	(0.041)***	(0.036)***	(0.005)***	(0.003)***	(0.002)***	(0.026)***	(0.088)***	(0.049)***
Export Only	1.356	1.003	0.345	0.045	0.030	0.026	0.178	0.123	0.216
	(0.069)***	(0.048)***	(0.038)***	(0.007)***	(0.005)***	(0.003)***	(0.032)***	(0.114)	(0.058)***
Import Only	0.513	0.330	0.180	0.022	0.010	0.016	0.091	0.060	0.107
	(0.041)***	(0.026)***	(0.023)***	(0.005)***	(0.003)***	(0.002)***	(0.020)***	(0.071)	(0.040)***
$Log(Labor)_t$			0.034				1.030	-0.016	-0.186
			(0.008)***				(0.007)***	(0.022)	(0.015)***
$Log(Sales)_{t-3}$				-0.008					
				(0.001)***					
$Log(Productivity)_{t-3}$					-0.059				
					(0.002)***				
$Log(Labor)_{t-3}$						-0.015			
						(0.001)***			
Observations	21507	27614	21530	16730	17624	23844	16251	6218	12745
R-squared	0.328	0.227	0.457	0.068	0.184	0.069	0.815	0.271	0.263

Robust standard errors clustered by country, industry, and year are in parentheses. In the regressions, I also control for 2-digit industry, survey year, and country fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

Table 7 shows the regression results for equation 8. The coefficients on all performance measures are significant at the 1% level. As expected, traders perform better than non-traders. In addition to being larger and more productive, they pay higher wages, invest more intensively, hire more non-production workers, and grow faster than non-traders. Among traders, two-way traders are the best performers. The results of Table 7 reveal analytical results of the model introduced above. Efficient producers self-select into foreign markets and among those only the most efficient ones can enter in both markets. This is because only those firms can overcome the sunk costs of entry into both markets. An important result of this estimation is that estimating export premium without controlling for import status is likely to overestimate the actual value by capturing the import premium.

In their performance rankings, two-way traders are followed by only-exporters. The lowest premium is observed in only-importers. This difference in the premiums might be due to higher sunk costs of exporting relative to importing. Hence the threshold productivity level is higher for exporting. It might also be due to low substitutability of foreign intermediate inputs with domestic inputs. Although it is difficult to determine what derives higher performance of trading firms from this descriptive analysis, the results are in accordance with several recent studies. In two studies that use the same grouping of firms with respect to their foreign exposure, Vogel and Wagner (2008) derive a similar conclusion for West and East Germany manufacturers. Using data from Belgium manufacturers, Muuls and Pisu (2007) also find similar results except only importers rank higher than only exporters in their analysis.

I also perform this descriptive analysis using the panel data for robustness. In these regressions, in order to control for reverse causality, the dependent variable at time (*t*) is regressed on the trading status of firms at time (*t-3*). In the growth rate regressions, I also use the values for the size of the firm at (t-3)[14]. The results are presented in Table 17 in the Appendix. The results of the panel regressions support the results presented in Table 7. The advantage of traders in size is more pronounced in the panel regressions. For the growth rates, only two-way traders grow significantly higher than non-traders for sales and productivity but for employment growth the picture is similar to the main regression results.

5 Empirical Model

Based on the theoretical model presented above, in this section I provide a detailed reduced form analysis of whether participating in international markets is related to the heterogeneity in firm

[14] These size values are from the surveys conducted at time (*t-3*) not the retro respective values from the surveys conducted at (*t*).

evolution. To identify this relation, I use alternative measures of firm evolution and I benefit from a rich set of control variables.

To measure firm evolution, I look at growth rates as explained in the descriptive analysis section. In addition to these, I look at variables that proxy for technological innovations. Enterprise surveys provide information on the probabilities of introducing new products, improving existing processes, using various quality certificates such as ISO 9000 or 9002, and use of foreign licenses. Since the seminal works of Grossman and Helpman (1991) and Aghion and Howitt (1992), it has been argued that firms grow as a result of innovation and technology adoption. These measures of innovation would be interpreted as firms' adoption of production technologies, methods, or knowledge that were not available to them. This interpretation of innovation is more preferable than the interpretation we would consider for the developed countries. In other words, in developing countries firms' innovations should be thought as approaching the frontiers of technology or production methods rather than extending these frontiers.

As was shown in the model introduced in section 2, innovations are the main drivers of firm growth. Since firm level output prices are not available, measured values of productivity and sales can be affected by both output and input price movements. These movements can affect the growth rates of sales and productivity. On the other hand, the measures of innovation as well as employment growth are not affected from such price movements. The use of various measures of firm evolution, growth rates and technological innovation rates improves the reliability of the analysis.

Table 8 Firm Evolution and Technological Innovation

	Dependent Variables		
	Employ Growth	Sales Growth	Log(Proy)
Prod Innov	0.021 (0.002)***	0.044 (0.003)***	0.167 (0.018)***
Proc Innov	0.025 (0.002)***	0.024 (0.004)***	0.226 (0.032)***
Foreign Lic	0.013 (0.003)***	0.012 (0.005)**	0.419 (0.039)***
Quality Cert	0.004 (0.002)*	0.024 (0.004)***	0.169 (0.040)***

Robust standard errors clustered by country, industry, and year. In the regressions, I control for 2-digit industry, survey year, and country fixed effects. ***p<0.01, ** p<0.05, *p<0.1.

The data show that measures of technological innovation are positively and significantly correlated with firm growth. Table 8 shows the results of regressing growth rates of size and log of productivity on the proxy measures of technological innovation. Each cell in the table shows the results from regressing the dependent variables on one of the innovation measures. In each regression, I control for 2-digit industry, survey year, and country fixed effects. Regression results show that firms that introduce new products over the past three years grew 2.1% faster in employment and they are 17% more productive than the firms that did not introduce a new product. The table clearly shows the positive relation between the innovation measures, productivity and growth rates.

Following from the analytical model I estimate a reduced form probit model. The dependent variable measures whether the firm is engaged in technological innovation. The particular the model I estimate is as follows:

$$\Pr\left(z_{ijc}=1\right)=\Pr\left(\beta_1 d^{xm}{}_{ijc}+\beta_2 d^{x}{}_{ijc}+\beta_3 d^{m}{}_{ijc}+\gamma X_{ijc}+\delta I_j+\lambda I_c+\mu I_t+\varepsilon_{ijc}>0\right) \quad (9)$$

where z_{ijc} is a discrete random variable equal to one if the *i*th firm in industry *j* in country *c* carries out a technological innovation. As in equation 8, in the right hand side of the equation there are three dummy variables $d^{xm}{}_{ijc}$, $d^{x}{}_{ijc}$, and $d^{m}{}_{ijc}$ that represent two-way traders, only importers, and only exporters in respective order. In addition, there is a vector of control variables representing firm, 2-digit industry, country, and survey year listed in respective order X_{ijc}, I_j, I_c and I_t. Inclusion of industry fixed effects here can control for the possible differences across industries in the interpretation of technological innovations.

In addition to reporting technological innovation variables, I report employment, sales, and labor productivity growth using ordinary least squares method. The equation for this estimation is given in equation 10

$$\dot{y}_{ijc}=\beta_0+\beta_1 d^{xm}{}_{ijc}+\beta_2 d^{x}{}_{ijc}+\beta_3 d^{m}{}_{ijc}+\gamma X_{ijc}+\delta I_j+\lambda I_c+\mu I_t+\varepsilon_{ijc}, \quad (10)$$

where $\dot{y}_{ijc}$ is the growth rate for the *i*th firm in industry *j* in country *c* and the right hand side variables are same as the ones used in equation 9. Finally, I include logarithm of productivity using the same specification given in equation 10.

The survey allows using a rich set of variables to control for firm characteristics that would affect its evolution. Both the theoretical and the empirical literature suggests that attributes like physical capital, human capital, size, age, and ownership structure are likely to affect firm evolution. Based on the analytical framework, size reflects the built-in knowledge capital of the firm as well as firm's efficiency level. Size is measured using log of total full time employees. Second, I include a dummy variable showing whether the firm conducts R&D. Including R&D in the estimation allows to isolate the relation between trade and technological innovation. To control for other unobserved factors like the level of human capital, I use the amount of training that the employees get and the ratio of non-production workers to production workers in the firm. The level of physical capital was excluded from the analytical model for simplicity but it is a crucial determinant of growth. As a proxy for that, I use log of aggregate investment per employee.

Finally, I control for the share of foreign ownership in the firm. This variable has been analyzed in many studies such as Criscuolo, Haskel, and Slaughter (2005) and Almeida and Fernandes (2008). Foreign ownership can facilitate the transfer of better technology to the firm which reduces the cost of R&D and promotes growth. For the ownership structure, I set a dummy variable equal to one for firms with more than 10% of foreign ownership. This level is used by statistical agencies in many countries (e.g., the U.S. Bureau of Economic Analysis) and it is the amount defined in IMF's Balance of Payment Manual (1993). Correlation matrix for all these variables is given in Table 9.

Table 10 shows the main estimation results. The first three columns show the growth rates of employment, sales, and productivity. The fourth column shows the log productivity and the fifth to ninth columns show the measures of technological innovation: product innovation, process innovation, use of foreign licenses, and use of quality certificate in respective order. The coefficients in the probit regressions show the marginal effects at the mean values and all standard errors are clustered at industry, country, and year level.

The estimation results show that firms with some level of foreign exposure perform better than non-traders. They grow faster; they are more productive and more innovative. The results are in accordance with the results from the descriptive regression analysis. Two-way traders are the best performers. They are followed by only exporters who are followed by only importers in almost all measures of interest. The coefficients identifying foreign exposure are highly significant despite of the large set of variables that control firm characteristics. For the employment growth, two-way traders grow 4% faster than the non-traders and only exporters grow 2% faster. The growth premium is slightly less for the only importers (1.5%). The significance of the results and the persistent ranking according to trade orientation in all growth rates and indicators of technology adoption leads to two conclusions. There exists a positive and significant relation between trade orientation of firms and their evolution and there is complementarity between importing and exporting in generating this heterogeneity in evolution.

Results in Table 10 only show that traders grow significantly faster than non-traders and they innovate more. In Table 11, I look at whether traders significantly differ among themselves in evolution. For each regression performed in Table 10, I test whether firms that trade significantly among themselves. The values in Table 11show the p-values for these tests. Test results show that two-way traders perform significantly better than only exporters in employment growth and product innovation and they perform better than only importers in all measures except in the use of foreign licenses. Only exporters grow faster than only importers in sales and productivity and they use more quality certificates than only importers. All these results are significant at 5 % level.

The coefficient of ownership in the estimation differs for growth rates and indicators of technology adoption. Although firms with foreign ownership grow faster than domestic firms, they show less product and process innovation than domestic firms but the results are only significant for process innovation. However they acquire more quality certificates and foreign licenses. Faster growth and lower or similar innovation rates might be interpreted as follows. Firms with foreign ownership use technology that is closer to frontier and apply methods that are more productive than the technology and methods used by domestic firms. Hence, they grow faster and have less need to improve their product scopes and processes.

Another result of the estimation is that large firms are more innovative. This is in accordance with the empirical evidence presented by Cohen and Klepper (1996). Also in the innovation function, size reflected knowledge capital stock that is accumulated through the firm's past innovations and more knowledge leads to more innovation. The other determinant of innovation function, R&D investment is also significantly related to firm growth and innovation. On the relation between the growth rates and size, we see the mean reverting behavior. Conditional on survival, smaller firms grow faster than large firms. This negative relation between growth rate and size has been shown in many studies. Two recent examples are Rossi-Hansberg and Wright (2007) and Lentz and Mortensen (2008). Similar inferences are driven for revenue and productivity growth. The variable that is used to control for human capital such as training is significantly correlated with firm growth and technology adoption. The share of non-production workers is negatively related to employment growth but positively related to productivity growth product innovation, and use of quality certificates. The proxy for physical capital, investment per worker is positively related to all variables except employment growth. Finally control for age shows that younger firms are more dynamic than old firms. They grow faster in size and they innovate more. However the effect of age seems to be small.

Overall, the estimation results show that despite a large set of firm, industry, and country level controls the positive relation between trade orientation of firms and their evolution is strong. Firms integrated with global markets grow faster and are more likely to adapt better technologies than the firms serving only domestic markets.

Table 9 Correlation Matrix for the Variables Used

	Export/ Import	Import Only	Export Only	Log $(Labor)_{t-3}$	Foreign (≥%10)	Log(Inv /Worker)	NonProd /Prod Work	R&D Ind	Training	Age	Log $(Sales)_{t-3}$
Import Only	-0.361*										
Export Only	-0.161*	-0.205*									
$Log(Labor)_{t-3}$	0.328*	-0.107*	0.089*								
Foreign (≥%10)	0.222*	-0.038*	0.059*	0.252*							
Log(Invest/Worker)	0.073*	-0.023*	0.033*	-0.167*	0.026*						
NonProd Worker Share	-0.008	0.015	-0.011	-0.099*	0.040*	0.066*					
R&D Ind	0.101*	-0.017*	0.020*	0.129*	0.118*	0.019	0.028*				
Training	0.228*	0.008	0.030*	0.310*	0.113*	0.079*	0.012	0.079*			
Age	0.143*	-0.047*	0.037*	0.364*	-0.016	-0.001	-0.036*	0.006	0.131*		
$Log(Sales)_{t-3}$	0.331*	-0.083*	0.091*	0.676*	0.216*	0.209*	-0.068*	0.177*	0.324*	0.298*	
$Log(Productivity)_{t-3}$	0.121*	0.002	0.043*	-0.071*	0.057*	0.496*	0.039*	0.060*	0.122*	0.030*	0.687*

* Shows significance of coefficients at 1%.

Table 10 Trade Orientation and Firm Evolution

	Employ Growth	Sales Growth	Proy Growth	Log (Proy)	Prod Innov	Proc Innov	Foreign Lic	Quality Cert
Export/Import	0.037	0.048	0.028	0.214	0.193	0.091	0.122	0.141
	(0.004)***	(0.008)***	(0.005)***	(0.042)***	(0.015)***	(0.020)***	(0.030)***	(0.022)***
Export Only	0.020	0.043	0.021	0.150	0.142	0.073	0.104	0.109
	(0.005)***	(0.010)***	(0.007)***	(0.042)***	(0.022)***	(0.022)***	(0.044)**	(0.033)***
Import Only	0.015	0.019	0.009	0.125	0.132	0.046	0.092	0.013
	(0.004)***	(0.006)***	(0.004)**	(0.029)***	(0.014)***	(0.020)**	(0.027)***	(0.018)
Foreign (≥%10)	0.015	0.025	0.027	0.170	-0.020	-0.057	0.113	0.049
	(0.004)***	(0.007)***	(0.004)***	(0.026)***	(0.016)	(0.027)**	(0.026)***	(0.020)**
Log(Invest/Worker)	-0.000	0.011	0.022	0.263	0.010	0.002	0.006	0.031
	(0.001)	(0.002)***	(0.002)***	(0.011)***	(0.004)**	(0.005)	(0.004)	(0.005)***
NonProd Worker Share	-0.012	0.008	0.024	0.261	0.072	-0.046	0.025	0.076
	(0.004)***	(0.007)	(0.005)***	(0.060)***	(0.024)***	(0.017)***	(0.014)*	(0.028)***
R&D Ind	0.019	0.014	0.003	0.147	0.141	0.189	0.042	0.080
	(0.003)***	(0.006)**	(0.004)	(0.025)***	(0.018)***	(0.015)***	(0.014)***	(0.017)***
Training	0.023	0.029	0.012	0.110	0.107	0.133	0.055	0.181
	(0.003)***	(0.005)***	(0.003)***	(0.020)***	(0.013)***	(0.018)***	(0.014)***	(0.015)***
Age	-0.001	-0.000	0.001	-0.000	-0.001	-0.000	-0.000	0.001
	(0.000)***	(0.000)***	(0.000)***	(0.001)	(0.000)*	(0.000)	(0.000)	(0.000)**
Log(Labor)$_{t-3}$	-0.021			0.069	0.009	-0.001	0.034	0.073
	(0.001)***			(0.009)***	(0.005)*	(0.007)	(0.006)***	(0.006)***
Log(Sales)$_{t-3}$		-0.014						
		(0.002)***						
Log(Productivity)$_{t-3}$			-0.077					
			(0.003)***					
Observations	8355	7193	7792	8827	9311	3622	3628	9189
R2 /Pseudo R2	0.121	0.094	0.246	0.590	0.158	0.162	0.134	0.370

Robust standard errors clustered by country, industry, and year are in parentheses. In the regressions, I control for 2-digit industry, survey year, and country fixed effects. Coefficients for the probit regressions show the marginal effects at their mean values. *** p<0.01, ** p<0.05, * p<0.1.

Table 11 P values for the Tests on the Coefficients of Regressions

	Employ Growth	Sales Growth	Proy Growth	Log (Proy)	Prod Innov	Proc Innov	Foreign License	Quality Cert
p(Export/Import=Export)	0.000	0.617	0.278	0.103	0.030	0.692	0.296	0.294
p(Export/Import=Import)	0.000	0.000	0.000	0.009	0.000	0.008	0.067	0.000
p(Export=Import)	0.385	0.010	0.044	0.541	0.575	0.235	0.984	0.004

6 Sensitivity Analysis with Additional Controls

In this section I analyze the robustness of the findings. The estimation results in Table 10 show strong correlation between trade orientation of firms and their evolution. Although it is difficult to make a causal inference due to lack of strong instruments or a panel dataset, this problem is alleviated by controlling various firm characteristics, industry, country, and year fixed effects. In this section I check the robustness of estimation results by introducing further controls that can affect the observed relation between trade and firm evolution. Firm characteristics such as the level of foreign ownership, access to finance, capacity utilization, and being a multi-plant firm or factors like the level of competition in the markets can be simultaneously correlated with firm evolution and global engagement of the firm. I analyze whether the relation between trade and evolution persists under these additional controls. I perform the analysis including all control variables and for all measures of growth and innovation that are included in the main regression analysis presented in Table 10. However, for brevity, I present only the coefficients of trade orientation, foreign ownership, R&D indicator and the additional control variable included for the robustness analysis and I only show the results for employment growth and product innovation. The results for the measures of growth and innovation that are excluded in tables for sensitivity analysis are quite similar[15]. All estimation results with these additional control variables are given in Table 10 and Table 12. The former table shows the results for employment growth and the latter one shows the results for product innovation.

In the first estimation, I elaborate on the definition of foreign ownership. Instead of using a dummy variable representing all firms with more than 10% foreign ownership, I use two dummy variables with more than 50% of foreign ownership representing majority foreign owned and less than 50% representing minority foreign owned firms. The relation between trade orientation of firms and their evolution is not affected by this additional control. Only firms where the majority is

[15] All these tables are available upon request.

owned by foreigners grow faster than domestic firms. On the other hand, foreign owned firms innovate less than the domestic firms but the result is not significant.

Table 12 All Employment Growth

	Employment Growth						
Export/Import	0.036	0.030	0.031	0.035	0.030	0.040	0.033
	(0.004)***	(0.004)***	(0.004)***	(0.006)***	(0.005)***	(0.005)***	(0.006)***
Export Only	0.020	0.016	0.016	0.019	0.014	0.019	0.021
	(0.005)***	(0.006)***	(0.006)***	(0.009)**	(0.006)**	(0.007)***	(0.009)**
Import Only	0.016	0.011	0.012	0.014	0.011	0.016	0.014
	(0.004)***	(0.004)***	(0.004)***	(0.006)**	(0.004)***	(0.005)***	(0.006)**
Foreign (≥%10)		0.016	0.015	0.007	0.009	0.015	0.008
		(0.004)***	(0.004)***	(0.006)	(0.004)**	(0.005)***	(0.006)
R&D Ind	0.019	0.020	0.020	0.018	0.021	0.023	0.017
	(0.003)***	(0.003)***	(0.003)***	(0.004)***	(0.003)***	(0.004)***	(0.004)***
Foreign (≥50%)	0.016						
	(0.004)***						
Foreign (<50%)	0.010						
	(0.006)						
Access to Finance		0.022					0.018
		(0.003)***					(0.004)***
% Financed			0.0002				
			(0.000)***				
Multi-plant firm				0.005			0.005
				(0.006)			(0.006)
Total Hrs/Week					0.0003		0.000
					(0.000)***		(0.000)***
log(Markup)						-0.003	
						(0.003)	
Observations	8390	7413	7413	3326	6196	4589	3284
R2 /Pseudo R2	0.121	0.125	0.122	0.122	0.136	0.121	0.136

Robust standard errors clustered by country, industry, and year are in parentheses. All regressions control for log(investment/worker), Non-production worker share, training, age, Log(Labor)_{t-3}. They also control for 2-digit industry, survey year, and country fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

Access to finance is an important factor for firm evolution. Firms with easier access to external finance could find it easier to access to foreign markets. They can find it cheaper to compensate the sunk costs required to export or import. Using external financial sources for productive investment purposes, they are also likely to grow faster. Hence, when omitted, this variable can be a factor explaining the positive relation between foreign exposure and growth. To control for this, I include a dummy variable showing firms that use external sources to finance their investment. The estimation results show that access to external finance is positively and significantly related to growth and innovation. As an alternative measure, instead of using a dummy variable for measuring access to finance, I use the amount of total investment that is financed through some financial intermediary. The results are very similar. Both measures of access to finance don't seem to affect the relation between firm's evolution and its foreign exposure.

Table 13 All Product Innovation

	Product Innovation						
Export/Import	0.193	0.179	0.181	0.124	0.187	0.209	0.121
	(0.015)***	(0.016)***	(0.015)***	(0.020)***	(0.017)***	(0.020)***	(0.020)***
Export Only	0.142	0.124	0.126	0.064	0.124	0.183	0.059
	(0.022)***	(0.023)***	(0.023)***	(0.031)**	(0.026)***	(0.029)***	(0.032)*
Import Only	0.132	0.123	0.126	0.113	0.137	0.108	0.110
	(0.014)***	(0.016)***	(0.016)***	(0.021)***	(0.017)***	(0.018)***	(0.022)***
Foreign (≥%10)		-0.024	-0.027	-0.061	-0.033	-0.009	-0.053
		(0.018)	(0.018)	(0.027)**	(0.021)	(0.020)	(0.027)**
R&D Ind	0.147	0.156	0.157	0.215	0.146	0.020	0.212
	(0.025)***	(0.018)***	(0.018)***	(0.014)***	(0.018)***	(0.021)	(0.014)***
Foreign (≥50%)	-0.023						
	(0.017)						
Foreign (<50%)	-0.002						
	(0.036)						
Access to Finance		0.076					0.037
		(0.012)***					(0.015)**
% Financed			0.001				
			(0.000)***				
Multi-plant firm				0.021			0.021
				(0.028)			(0.028)
Total Hrs/Week					0.000		-0.000
					(0.000)		(0.000)
log(Markup)						0.028	
						(0.013)**	
Observations	8862	8260	8260	3636	6850	5166	3589
R2 /Pseudo R2	0.591	0.161	0.160	0.136	0.167	0.0933	0.138

Robust standard errors clustered by country, industry, and year are in parentheses. All regressions control for log(investment/worker), Non-production worker share, training, age, Log(Labor)_{t-3}. They also control for 2-digit industry, survey year, and country fixed effects. Coefficients for the probit regressions show the marginal effects at mean values.
*** p<0.01, ** p<0.05, * p<0.1.

In their detailed analysis of firm dynamics, Dunne, Roberts, and Samuelson (1988) conclude that multi-plant firms are more likely to survive and grow faster than single plant firms. Although their number is small, in the dataset some of the firms are part of a larger firm. To see whether this effects the relation between trade orientation of firms and their evolution, I include a dummy variable for multi-plant firms. Since this information is only available for 2006 and 2008 surveys, with its inclusion, number of observations decreases significantly. Being a part of a multi-plant firm does not contribute to growth or innovation significantly. Two-way traders perform significantly better than non-traders in both growth rates and innovation. For technological innovation variable only importers innovate more than only exporters.

Next, I add total number of hours worked per week to control for capacity utilization. Becheikh et al. (2006) present evidence that firms that use their resources more efficiently are more likely to innovate and grow. This is especially valid for process innovation. If firms are producing at a capacity close to their limits, they might be inclined to improve their processes that will lead to more access capacity. Estimation results show that firms with higher capacity utilization grow faster[16]. However the magnitude is small, a 10 hour increase in total hours worked per week leads to 0.3% increase in employment growth. Although not presented, I use an alternative measure of capacity utilization which is measured as the firm's actual output relative to its maximum possible output. Using this measure also gives similar results and doesn't affect the relation between trade and growth.

Finally I analyze whether the link between trade and firm evolution is affected by the degree of market competition that the firm faces. The literature on relation between market competition and innovation gives mixed results. On one hand, it is predicted that innovation should decline with competition, because competition reduces monopoly rents that the innovations yield. A classical example is Aghion and Howitt (1992). On the other hand, Shaked and Sutton (1987) argue that innovation increases product differentiation and this should cause it to increase with competition. A more recent study by Aghion et al. (2005) introduces a model that combines these two relations and gets a negative-U shaped relation between competition and innovation. To measure competition, I look at the markup that the firm charges. For this variable, data is only available for ECA 2002 and 2005 surveys. For both growth rate and product innovation, two-way traders perform better than only exporters who perform better than only importers. As the amount of markup increases (implying less competition in the market), probability of innovating new products increases.

[16] I only included firms with total hours/week ≥ 25.

7 Analysis Using the Panel Data

In this section, I use the balanced panel dataset constructed from the survey to provide further support for the relation between trade orientation of firms and their evolution and alleviate the endogeneity problem. Using the panel data allows me to control for the unobserved firm fixed effects. I ran several experiments with the panel data. In the first experiment, I regress growth rate between time (t-3) and t and probability of introducing a new variety between time (t-3) and (t) on trading status of the firm in (t-3). As additional firm level controls, I introduce firm's ownership status, its size, and its age all from time (t-3)[17]. In addition, I include the country, industry, and survey year controls. The results which are given in Table 14 are in accordance with the results presented in Table 10. Trading firms grow faster than non-trading firms. Two-way traders are the fastest growing and most innovative group. Only exporters no longer grow significantly higher than non-traders. For product innovation, all three trading groups are significantly different from non-traders. As before, foreign ownership contributes to growth but is negatively related to product innovation.

In the second experiment, I restrict the sample to the firms who didn't trade at (t-3) and run the same regressions as above. This experiment shows that among the firms who didn't trade at time (t-3) which group had the highest growth rate over the three year period. The results show that, two-way traders were the fastest growing group. They also were the most innovative group. Following two-way traders, only-importers were the second most innovative group of firms. In the last experiment, I include the firm level fixed effects in the regression[18]. Results show that two-way traders and only exporters grow significantly higher than non-traders. Overall, the results of the analysis from the panel data are in accordance with the results presented in section 5.

[17] In the panel regressions, indicator variable for past R&D investment was excluded as the inclusion of this variable decreased the sample size by more than half. This led to few observations in each trade group.
[18] I run this regression only for employment growth. I also ran the random effect regression and tested which method was appropriate using the Hausman test. The test result strongly rejected the efficiency of random effects model.

Table 14 Trade Orientation and Firm Evolution: Panel Regressions

	Employment Growth			Product Innovation	
	Full Panel (1)	$(\text{Non-traders})_{t-3}$ (2)	Fixed Effect (3)	Full Panel (1)	$(\text{Non-traders})_{t-3}$ (2)
$(\text{Export/Import})_{t-3}$	0.090			0.167	
	(0.024)***			(0.037)***	
$(\text{Export})_{t-3}$	0.046			0.102	
	(0.030)			(0.036)***	
$(\text{Import})_{t-3}$	0.037			0.134	
	(0.016)**			(0.027)***	
Foreign (≥%10)	0.063	0.045	0.008	-0.033	-0.146
	(0.024)***	(0.062)	(0.009)	(0.034)	(0.111)
Age	0.001	0.002	0.000	-0.001	-0.003
	(0.000)***	(0.001)**	(0.000)***	(0.001)*	(0.001)**
Log(Labor)_{t-3}	-0.064	-0.085	-0.066	0.042	0.078
	(0.009)***	(0.014)***	(0.004)***	(0.011)***	(0.018)***
$(\text{Export/Import})_{t}$		0.276	0.024		0.311
		(0.127)**	(0.007)***		(0.086)***
$(\text{Export})_{t}$		0.007	0.022		0.157
		(0.030)	(0.007)***		(0.106)
$(\text{Import})_{t}$		0.004	0.004		0.166
		(0.018)	(0.004)		(0.035)***
Observations	2537	879	5503	2533	862
R2 /Pseudo R2	0.093	0.184	0.134	0.111	0.127

Robust standard errors clustered by country, industry, and year are in parentheses. I control for 2-digit industry, survey year, and country fixed effects except in the FE regression for employment growth. Coefficients for the probit regressions show the marginal effects at mean values. In the table (1) is the regression using past values of the dependent variables (at t-3), (2) constrains the sample to the non-trading firms at (t-3), (3) is the fixed effect regression for employment growth.*** p<0.01, ** p<0.05, * p<0.1

8 Trade Orientation and R&D Relation

A number of studies following from Cohen and Levinthal (1989) have argued that R&D investment has two roles in firm performance: directly leading to more innovation and allowing firms to assimilate knowledge or expertise from external sources (spillover effect). To see how important the second link is, I introduce an interaction term between R&D investment and trade orientation of the firm.

Table 15 Trade Orientation and R&D Interaction

	Employ Growth	Prod Innov
Export/Import	0.028	0.163
	(0.005)***	(0.024)***
Export Only	0.016	0.101
	(0.008)**	(0.037)***
Import Only	0.009	0.129
	(0.004)**	(0.019)***
Export/Import*R&D	0.015	0.056
	(0.006)**	(0.033)*
Import Only*R&D	0.012	0.007
	(0.006)**	(0.026)
Export Only*R&D	0.008	0.081
	(0.010)	(0.048)*
R&D Inv Indicator	0.010	0.117
	(0.004)**	(0.024)***
Foreign (≥%10)	0.014	-0.021
	(0.004)***	(0.016)
Observations	8355	9311
R2 /Pseudo R2	0.122	0.158

Robust standard errors clustered by country, industry, and year are in parentheses. The regressions control for Log(investment/worker), Non-production worker share, training, age, Log(Labor)_{t-3}, 2-digit industry, survey year, and country fixed effects. Coefficients for the probit regression shows the marginal effects at mean values. *** p<0.01, ** p<0.05, * p<0.1.

The results are given in Table 15. R&D contributes significantly to the growth of two-way traders and only importers. For the results on product innovation, R&D significantly contributes to growth of two-way traders and only-exporters. These results show that R&D contributes to growth of trading firms more than it contributes to non-traders. Aw, Roberts and Winston (2007) who analyze the determinants of future profitability get similar results. They get a positive and significant coefficient on the interaction term between R&D and export variable. However, they do not incorporate the importing decision of the firm in their study.

9 Conclusion

Recent trade models with heterogeneous firms have shown that exporters are larger, more productive, more capital intensive, and pay higher wages than firms serving only the domestic market. However, the relation between firm growth and global engagement is less clear. In this study, using a detailed firm level dataset from 43 countries, I analyze whether firms with foreign exposure grow faster than domestic firms. In analyzing foreign exposure, in addition to exporting, I also analyze importing. Several studies have shown that importers are quite similar to exporters in their evolution. Hence both activities need to be evaluated carefully in order to provide a sound answer to how trade is related to growth.

I investigate the relation between firm growth and its trade orientation by dividing firms into four distinct groups: two-way traders, only exporters, only importers, and non-traders. This classification allows me to see whether importing or exporting is more strongly related to faster firm growth. I use several direct and indirect measures to find growth. As direct measures, I look at growth rates of employment, sales, and productivity. As indirect measures, I look at innovations that firms introduce. More specifically, I look at the probabilities of introducing new varieties, improving existing production processes, using internationally recognized quality certificates, and using foreign licenses. There is vast amount of theoretical and empirical evidence that relates technological innovations to firm growth. I also show the strong correlation between these measures in the data. Analyzing firm evolution with a rich set of variables increases the reliability of the analysis.

Based on the analytical framework introduced in this study, I estimate a reduced form model. Several interesting results emerge from the analysis. Two-way traders grow faster and innovate more than any other group of firms. They are followed by only exporters. This result shows that not only all firms but also exporters are heterogeneous among themselves and the best performers among them are the ones who import intermediate products. There is complementarity between two aspects of trade. In their rankings of performance, two-way traders and only exporters are followed by only importers. Non-traders are the least growing and innovating group of firms.

Another finding of the study is on the relation between foreign ownership and growth. Firms with some level of foreign ownership grow faster than purely domestic firms. However, they are not more innovative than domestic firms. This result shows that firms with foreign ownership use technology that is closer to the frontier and hence have less incentive to innovate to be able to grow. For the other variables of interest, R&D is positively and significantly related to growth and innovation. Further analysis of the interaction between R&D investment and global engagement shows that there is complementarity between R&D and trade orientation in generating growth.

To check the robustness of the findings, I include further firm characteristics as control variables such as access to finance, a more detailed foreign ownership variable, capacity utilization, and being part of a multi-plant firm, which are likely to be correlated with the growth, innovation and trade orientation of the firm. I also include variables to control for the market competition that the firm faces. The positive relation between trade and growth persists under these additional control variables. As a second robustness check, I use a panel dataset constructed from the original dataset. Evidence from the panel data is in accordance with the main regression results.

The lack of a long panel dataset makes it difficult to interpret the relations as causal. However, the strong correlation between direct and indirect measures of growth and trade under a rich set of control variables shows the importance of the relation between importing, exporting, and firm evolution. The evidence from the panel data analysis reinforces this conclusion.

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APPENDIX

Table 16 Countries Included

Country	2002	2003	2005	2006	2008	Total
Albania	170	0	204	0	65	439
Argentina	0	0	0	746	0	746
Armenia	171	0	351	0	115	637
Azerbaijan	170	0	350	0	118	638
Belarus	250	0	325	0	104	679
Bolivia	0	0	0	409	0	409
Bosnia	182	0	200	0	124	506
Bulgaria	250	0	300	0	96	646
Chile	0	0	0	697	0	697
Colombia	0	0	0	649	0	649
Croatia	187	0	236	0	67	490
Czech	268	0	343	0	107	718
Ecuador	0	175	0	394	0	569
El Salvador	0	306	0	467	0	773
Estonia	170	0	219	0	90	479
FYROM	170	0	200	0	122	492
Georgia	174	0	200	0	125	499
Guatemala	0	226	0	328	0	554
Honduras	0	216	0	263	0	479
Hungary	250	0	610	0	116	976
Kazakhstan	250	0	585	0	184	1,019
Kyrgyzstan	173	0	202	0	97	472
Latvia	176	0	205	0	89	470
Lithuania	200	0	205	0	104	509
Mexico	0	0	0	1,161	0	1,161
Moldova	174	0	350	0	108	632
Nicaragua	0	240	0	365	0	605
Panama	0	0	0	243	0	243
Paraguay	0	0	0	440	0	440
Peru	0	0	0	361	0	361
Poland	500	0	975	0	158	1,633
Romania	255	0	600	0	184	1,039
Russia	506	0	601	0	706	1,813
Slovakia	170	0	220	0	90	480
Slovenia	188	0	223	0	98	509
Tajikistan	176	0	200	0	115	491
Turkey	514	0	557	0	903	1,974
Ukraine	463	0	594	0	581	1,638
Uruguay	0	0	0	396	0	396
Uzbekistan	260	0	300	0	121	681
Kosovo	0	0	0	0	103	103
Montenegro	0	0	0	0	37	37
Serbia	0	0	0	0	136	136
Total	6,417	1,163	9,355	6,919	5,063	28,917

Table 17 Descriptive Regressions (Panel Data)

Dependent Variable	Log (Sales)	Log (Employment)	Log (Productivity)	Sales Growth	Prod Growth	Employ Growth	Log(Invest /Worker)	NonProd /Prod
$(\text{Export/Import})_{t-3}$	2.274	1.630	0.528	0.254	0.143	0.086	0.419	0.053
	(0.139)***	(0.095)***	(0.071)***	(0.069)***	(0.037)***	(0.020)***	(0.115)***	(0.018)***
$(\text{Export Only})_{t-3}$	1.110	0.726	0.390	0.062	0.077	0.051	0.260	0.051
	(0.206)***	(0.126)***	(0.102)***	(0.054)	(0.052)	(0.026)*	(0.177)	(0.027)*
$(\text{Import Only})_{t-3}$	0.795	0.479	0.293	0.036	0.010	0.034	0.390	0.055
	(0.104)***	(0.072)***	(0.057)***	(0.034)	(0.030)	(0.013)**	(0.103)***	(0.016)***
Log(Labor)_{t}			0.065				-0.225	-0.044
			(0.021)***				(0.036)***	(0.005)***
Log(Sales)_{t-3}				-0.111				
				(0.022)***				
$\text{Log(Productivity)}_{t-3}$					-0.327			
					(0.056)***			
Log(Labor)_{t-3}						-0.057		
						(0.007)***		
Observations	2473	2905	2493	1632	1635	2898	1434	2827
R-squared	0.374	0.256	0.499	0.195	0.346	0.089	0.294	0.12

Robust standard errors clustered by country, industry, and year are in parentheses. In the regressions, I control for 2-digit industry, survey year, and country fixed effects. *** p<0.01, ** p<0.05, * p<0.1.